

PRELIMINARY DATA SUMMARY

January 1987

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

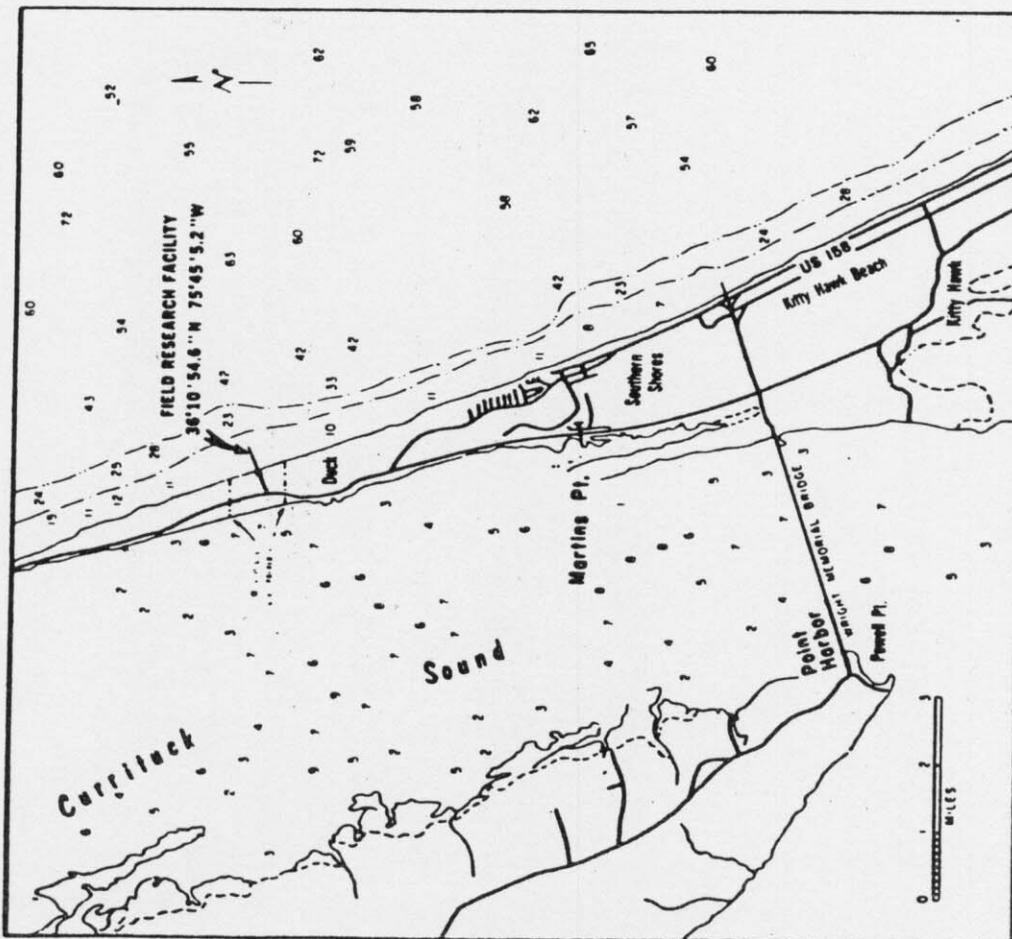
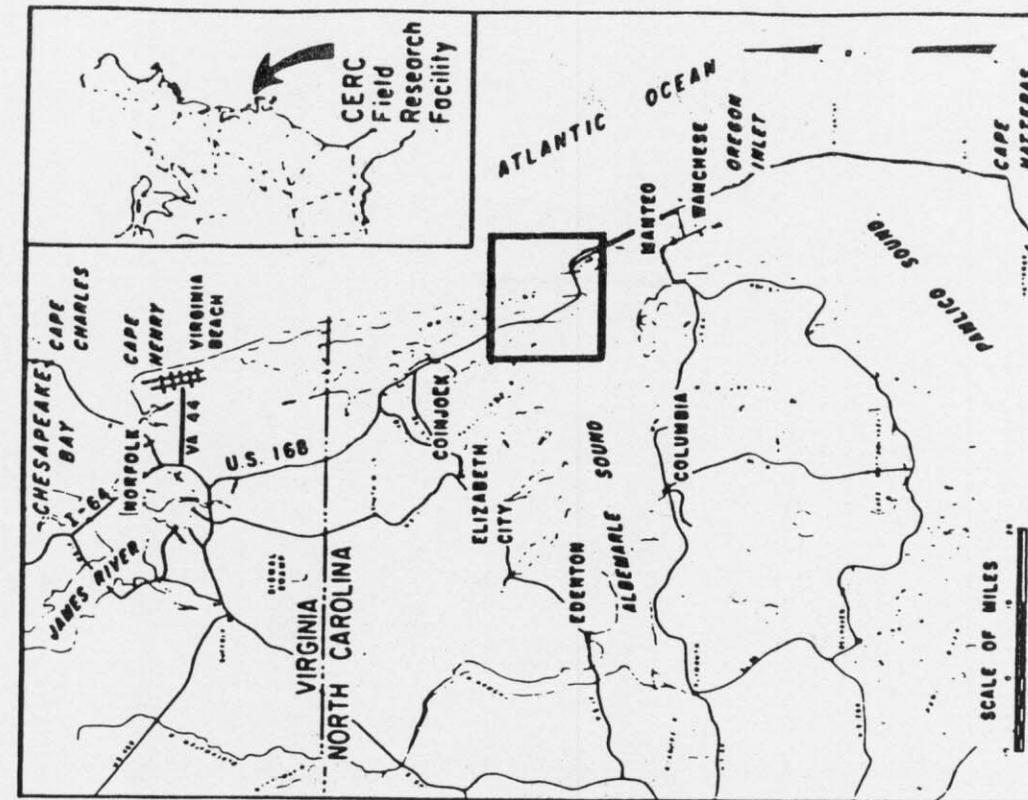


Figure 1. FRF Location Map

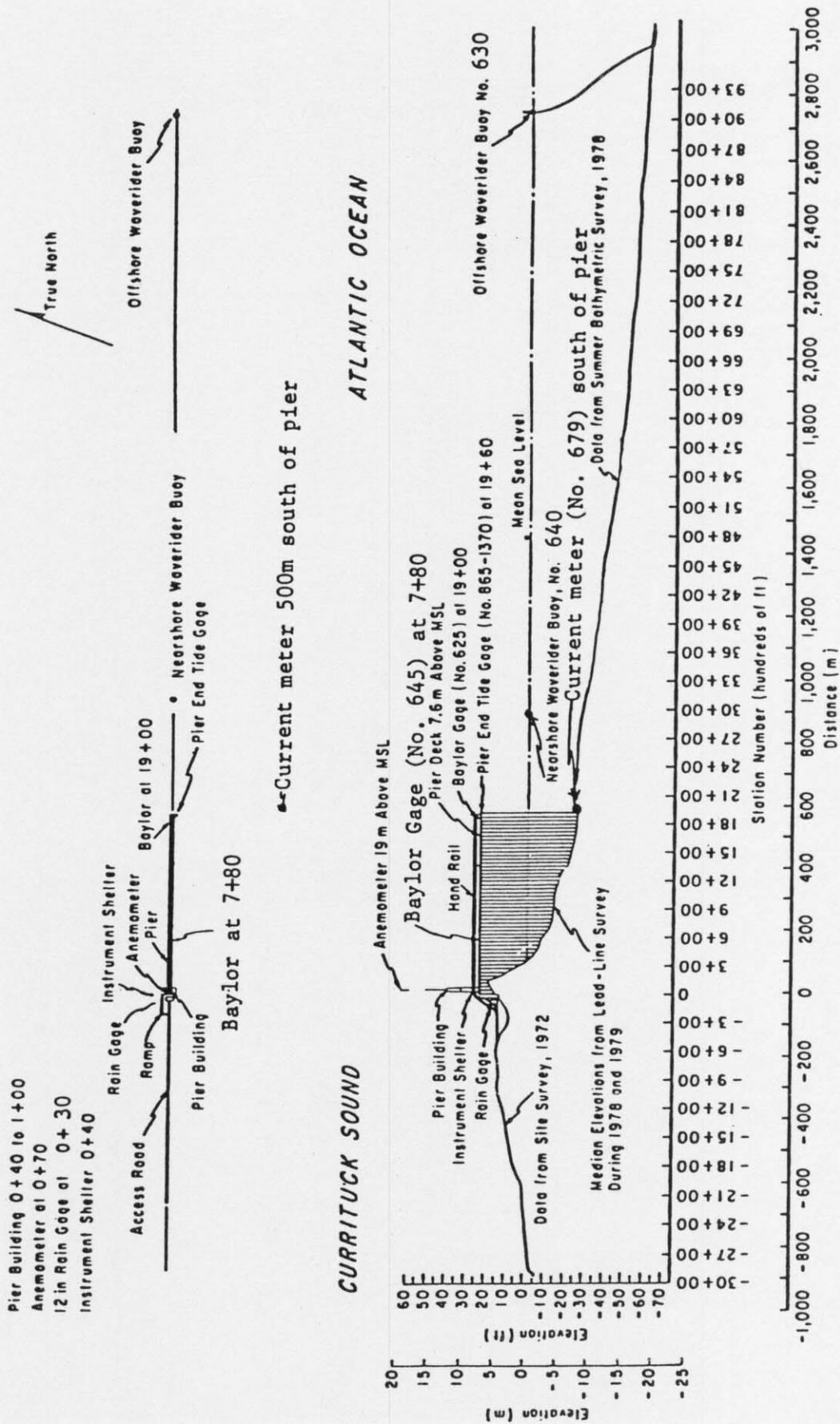


Figure 2. Instrument locations at FRF.

II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Data General NOVA-4 computer. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -
 $\text{mm} \times .03937 = \text{in}$
2. Millibars (mb) to inches of mercury (in Hg) -
 $\text{mb} \times 0.02953 = \text{in Hg}$
3. Degrees Celcius (C) to degrees Fahrenheit (F) -
 $(\text{C} \times 9/5) + 32 = \text{F}$
4. Meters per second (m/s) to knots (kn) -
 $\text{m/s} \times 1.943 = \text{kn}$

TABLE 2: Meteorological Data

JAN 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
1	100	16	45	12.3	1023.7	0
	700	16	49	11.8	1027.1	0
	1300	17	56	11.9	1026.1	0
	1900	18	60	12.2	1026.1	0
2	100	11	89	14.2	1023.7	0
	700	12	101	14.3	1020.4	0
	1300	12	115	15.6	1013.9	0
	1900	4	184	18.4	1011.6	0
3	100	5	220	16.9	1006.5	0
	700	10	246	13.4	1009.9	0
	1300	9	248	14.1	1012.2	0
	1900	5	253	12.9	1016.3	0
4	100	7	290	9.8	1018.7	0
	700	7	314	6.1	1022.7	0
	1300	5	252	10.0	1023.1	0
	1900	4	274	8.9	1025.1	0
5	100	5	279	7.6	1026.1	0
	700	8	26	8.6	1027.8	0
	1300	6	9	9.0	1029.2	0
	1900	7	358	6.9	1031.9	0
6	100	9	19	6.4	1032.6	0
	700	7	36	6.8	1033.2	0
	1300	6	360	6.9	1023.1	0
	1900	0		4.0	1020.7	0
7	100	4	238	5.2	1017.7	0
	700	7	231	6.0	1013.9	0
	1300	6	241	11.3	1010.9	0
	1900	3	250	8.6	1012.2	0
8	100	12	1	6.3	1016.3	0
	700	3	307	3.1	1019.0	0
	1300	7	5	6.7	1019.0	0
	1900	1	46	3.5	1020.0	0
9	100	0		1.6	1020.4	0
	700	3	63	5.1	1021.4	0
	1300	4	36	7.2	1021.7	0
	1900	3	110	6.3	1021.0	0
10	100	4	87	6.5	1017.7	0
	700	7	132	8.9	1010.5	0
	1300	4	239	10.9	1006.1	6
	1900	3	241	10.1	1003.4	5
11	100	3	324	8.0	1000.0	0
	700	7	291	4.9	1002.4	0
	1300	10	281	6.8	1004.1	0
	1900	9	274	6.3	1008.2	0
12	100	9	267	3.9	1009.2	0
	700	11	258	3.5	1007.2	0
	1300	9	281	9.4	1004.8	0
	1900	4	275	7.2	1007.8	0
13	100	8	348	4.5	1011.9	0
	700	4	302	2.1	1015.6	0
	1300	4	252	7.8	1016.6	0
	1900	0		5.4	1019.0	0
14	100	3	258	4.7	1020.7	0
	700	3	189	3.8	1021.4	0
	1300	6	223	13.5	1018.7	0
	1900	5	210	11.7	1018.7	0
15	100	5	219	10.7	1017.3	0
	700	4	220	10.9	1016.0	0
	1300	5	240	12.6	1014.6	0
	1900	4	244	10.0	1015.6	0
16	100	3	267	8.9	1017.0	0
	700	6	9	8.3	1019.3	0
	1300	9	2	7.9	1020.4	0
	1900	10	13	7.6	1020.4	0
17	100	14	12	6.4	1019.7	4
	700	12	16	6.9	1021.7	0
	1300	13	14	6.6	1023.4	0
	1900	12	17	6.2	1024.1	0
18	100	8	36	8.2	1020.7	0
	700	6	117	10.0	1015.6	3
	1300	2	335	10.5	1009.5	38
	1900	5	277	5.9	1012.9	0
19	100	4	228	5.7	1012.6	2
	700	5	98	7.0	1007.5	21
	1300	11	261	12.3	1000.0	7
	1900	14	265	12.2	1002.8	0
20	100	9	273	6.9	1012.2	0
	700	5	293	4.7	1017.7	0
	1300	4	20	6.7	1018.3	0
	1900	3	24	6.1	1018.3	0

TABLE 2: Meteorological Data

JAN 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
21	100	2	5	6.2	1016.0	0
	700	4	283	5.3	1018.0	0
	1300	1	307	6.9	1017.0	0
	1900	4	39	6.0	1018.3	0
22	100	8	30	6.6	1014.6	0
	700	12	41	8.0	1003.1	13
	1300	3	313	8.3	985.8	18
	1900	12	268	1.4	992.9	0
23	100	8	241	3.1	999.7	0
	700	7	233	2.7	1002.8	0
	1300	15	265	2.5	1004.4	0
	1900	11	275	-0.5	1014.3	0
24	100	8	286	-2.9	1020.0	0
	700	6	87	11.7	1021.7	0
	1300	8	247	6.3	1018.7	0
	1900	6	1	5.5	1020.7	0
25	100	6	26	4.2	1021.7	0
	700	8	31	4.2	1022.4	0
	1300	10	16	5.6	1018.0	0
	1900	10	15	7.1	1011.6	2
26	100	5	341	7.9	999.4	18
	700	10	313	1.0	1001.4	0
	1300	10	334	-1.6	1005.1	0
	1900	13	357	-0.7	1012.9	0
27	100	9	356	-0.6	1016.0	0
	700	7	331	-3.4	1017.0	0
	1300	10	342	-1.2	1017.3	0
	1900	6	321	-2.6	1018.0	0
28	100	6	306	-4.1	1018.0	0
	700	4	298	-4.3	1019.3	0
	1300	5	12	0.6	1019.7	0
	1900	10	8	5.4	1025.1	0
29	100	9	14	5.0	1024.8	0
	700	9	20	5.7	1025.4	0
	1300	3	2	2.3	1025.4	0
	1900	3	150	0.5	1023.4	0
30	100	7	128	3.4	1017.0	0
	700	4	205	7.5	1011.9	3
	1300	5	226	9.8	1006.1	0
	1900	3	213	10.0	1004.4	0
31	100	5	276	5.3	1001.7	0
	700	4	299	3.9	1005.8	0
	1300	9	310	4.8	1007.2	0
	1900	7	314	4.2	1011.6	0

III. WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645) and two Waverider buoys (Gages 630 and 640) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hrs near 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for 136 min (2 hr, 16 min) in four 34-min records.

Wave height (H_{m0}) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. The wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. The period (T_p) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed for all data records collected. Figure 3 is a time history of the H_{m0} and T_p values for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3. WAVE DATA

Part 1

JAN 1987

Day	Hour	645		625		640		630	
		Baylor at 7+80 Hmo(m)	T(sec)	Baylor at 19+00 Hmo(m)	T(sec)	Nearshr Wvrdr Hmo(m)	T(sec)	Farshr Wvrdr Hmo(m)	T(sec)
1	01	0.89	11.14	1.10	10.24	1.18	10.24		
	07	1.01	5.12	1.44	11.14	1.49	11.14		
	13	1.31	6.57	1.88	6.74	1.92	6.74		
	19	1.81	10.24	3.47	10.24		*		
2	01	1.66	14.22	2.76	11.64	2.75	10.66		
	07	1.81	11.64	2.18	11.64	2.45	11.64		
	13	1.23	10.66	1.44	10.24	1.55	10.66		
	19	0.90	9.48	1.09	9.84	1.06	9.84		
3	01	0.50	9.84	0.69	10.66	0.73	10.66		
	07	0.52	8.53	0.62	10.24	0.62	10.24		
	13	0.48	13.48	0.59	12.80	0.56	13.48		
	19	0.40	12.80	0.44	12.80	0.41	12.80		
4	01	0.32	12.80	0.42	12.20	0.43	11.64		
	07	0.73	5.33	0.93	5.45	0.96	5.45		
	13	0.75	5.69	0.91	5.69	0.97	5.82		
	19	0.82	4.34	1.04	4.49	1.05	4.27		
5	01	0.85	4.92	1.11	4.83	1.15	4.92		
	07	1.27	5.82	1.76	5.95	1.77	6.09		
	13	1.21	5.95	1.42	6.24	1.51	5.82		
	19	1.26	6.24	1.64	6.57	1.68	6.40		
6	01	1.27	6.74	1.57	7.32	1.62	6.74		
	07	0.96	5.95	1.27	7.11	1.29	7.53		
	13	0.86	5.33	1.04	7.32	1.07	5.95		
	19	0.77	4.41	0.86	7.53	0.91	7.32		
7	01	0.61	8.53	0.82	8.00	0.84	8.00		
	07	0.61	8.00	0.60	7.53	0.65	8.00		
	13	0.43	9.84	0.42	8.83	0.46	8.83		
	19	0.43	9.48	0.40	8.93	0.44	8.83		
8	01	1.24	5.33	1.31	5.33	1.47	5.22		
	07	1.15	6.09	1.36	6.24	1.41	6.24		
	13	0.89	5.56	1.04	5.95	1.12	5.95		
	19	0.86	5.56	0.83	6.24	0.89	5.95		
9	01	0.66	5.22	0.77	7.11	0.80	7.32		
	07	0.56	5.56	0.73	5.69	0.76	7.11		
	13	0.61	5.02	0.77	5.02	0.82	5.22		
	19	0.52	4.57	0.63	6.40	0.67	6.24		
10	01	0.45	4.57	0.52	9.84	0.58	9.48		
	07	0.56	3.20	0.66	3.28	0.68	3.28		
	13	1.17	6.57	0.98	6.92	1.02	6.40		
	19	0.99	7.53	0.82	7.32	0.91	7.32		
11	01	0.96	8.00	0.78	7.76	0.82	8.83		
	07	0.63	8.53	0.62	8.53	0.66	8.83		
	13	0.42	8.53	0.50	9.14	0.57	9.14		
	19	0.44	7.32	0.44	7.76	0.50	8.00		

Gage Inoperative

* Electronic problems

TABLE 3: WAVE DATA

Part 2

JAN 1987

Day	Hour	645		625		640		630	
		Baylor Hmo(m)	at 7+80 T(sec)	Baylor Hmo(m)	at 19+00 T(sec)	Nearshr Hmo(m)	Wvrdr T(sec)	Farshr Hmo(m)	Wvrdr T(sec)
12	01	0.35	7.32	0.32	9.14	0.40	9.14		
	07	0.34	6.92	0.30	7.53	0.39	8.83		
	13	0.33	6.92	0.38	6.92	0.46	7.53	0.68	3.4
	19	0.29	4.00	0.39	4.00	0.44	3.77	0.46	7.7
13	01	0.82	3.82	0.83	4.00	0.93	3.61	1.01	3.6
	07	1.24	6.09	1.39	6.57	1.49	6.74	1.91	6.5
	13	0.72	4.66	0.70	6.09	0.74	5.56	0.82	5.1
	19	0.44	5.22		*		*	0.74	9.1
14	01	0.55	8.26	0.75	8.26		*	0.87	8.2
	07	0.36	7.32	0.66	7.32		*	0.76	7.7
	13	0.37	17.06	0.57	7.11	0.61	7.11	0.70	7.5
	19	0.29	6.92	0.39	8.53	0.42	8.83	0.51	8.0
15	01	0.23	13.48	0.28	7.76	0.31	7.76	0.43	7.7
	07	0.20	10.66	0.24	8.83	0.25	12.20	0.32	12.2
	13	0.22	5.02	0.24	9.14	0.23	11.64		*
	19	0.25	6.57	0.24	8.83	0.25	6.24	0.32	6.5
16	01	0.30	8.00	0.27	7.53	0.30	8.00	0.36	6.5
	07	0.37	7.76	0.37	7.76	0.41	7.53	0.48	6.7
	13	0.96	4.13	0.97	4.49	0.97	4.41	1.17	4.7
	19	1.12	5.45	1.30	5.82	1.37	5.56	1.56	6.0
17	01	1.05	5.56	1.53	5.69	1.57	5.95	1.79	5.9
	07	1.43	6.74	2.05	7.11	1.97	7.11	2.32	6.7
	13	1.25	7.53	2.08	7.32	2.11	7.11	2.33	7.5
	19	1.37	7.32	2.05	7.76	1.96	8.00	2.23	7.5
18	01	1.11	5.69	1.57	6.57	1.60	7.32	1.77	6.7
	07	1.36	5.57	1.69	7.32	1.77	7.11	1.85	6.5
	13	1.27	8.83	1.82	9.14	1.93	8.53	1.98	8.8
	19	1.21	8.53	1.48	9.14	1.59	8.53	1.62	8.8
19	01	0.70	6.40	0.96	8.83	0.93	7.76	0.98	8.5
	07	0.69	6.92	0.98	8.83	0.96	8.83	1.06	8.5
	13	0.62	8.83	0.81	8.83	0.90	8.53	1.21	8.5
	19	0.70	8.00	0.74	6.92	0.90	8.00	1.24	8.0
20	01	0.44	8.53	0.51	8.53	0.53	8.00	0.72	7.1
	07	0.43	9.48	0.53	9.14	0.50	9.14	0.66	7.3
	13	0.56	7.32	0.72	7.76	0.75	7.76	0.90	8.2
	19	0.58	8.00	0.77	8.26	0.85	8.26	0.88	8.2
21	01	0.52	7.76	0.80	8.26	0.85	8.26	0.94	8.5
	07	0.50	8.00	0.84	8.26	0.87	8.83	0.98	9.1
	13	0.50	8.26	0.90	8.83	0.96	8.53	1.02	9.4
	19	0.59	10.66	0.90	10.66	0.92	9.84	0.97	10.6
22	01	0.72	4.57	1.05	10.24	1.05	10.24	1.05	11.1
	07	1.21	5.56	1.80	5.33	1.78	5.69	2.07	5.6
	13	1.39	7.53	2.00	7.32	1.95	7.53	2.34	7.3
	19	1.18	9.48	1.28	9.84	1.50	9.14	1.70	9.8

* Electronic problems

TABLE 3: WAVE DATA

Part 3

JAN 1987

Day	Hour	645		625		640		630	
		Baylor at 7+80 Hmo(m)	T(sec)	Baylor at 19+00 Hmo(m)	T(sec)	Nearshr Wvrdr Hmo(m)	T(sec)	Farshr Wvrdr Hmo(m)	T(sec)
3	01	0.77	11.64	0.98	11.14	1.11	11.14	1.22	11.14
	07	0.64	10.66	0.69	10.24	0.71	11.14	1.04	11.14
	13	0.35	10.66	0.49	10.66	0.63	10.24	1.12	3.24
	19	0.44	4.57	0.58	4.66	0.69	10.66	1.04	4.57
4	01	0.58	5.02	0.69	4.20	0.76	4.92	0.93	4.83
	07	0.31	4.20	0.44	11.14		*		*
	13	0.18	17.06	0.31	13.48	0.34	12.80	0.54	2.17
	19	0.24	14.22	0.36	14.22	0.35	14.22	0.39	14.22
5	01	0.49	3.77	0.56	3.77	0.59	3.66	0.59	3.66
	07	0.98	5.45	1.06	5.33	1.11	5.33	1.25	5.33
	13	0.99	5.56	1.13	5.45	1.23	5.12	1.27	5.45
	19	1.07	5.56	1.45	5.69	1.44	5.69	1.67	5.82
6	01	1.47	7.76	2.37	7.76	2.21	7.76	2.65	7.76
	07	1.36	8.26	1.85	8.53	1.81	8.26	2.24	8.26
	13	1.47	10.24	2.72	9.84	2.99	10.24	3.46	9.84
	19	1.52	11.14	2.62	11.14	2.81	10.66	3.05	10.66
7	01	1.52	12.20	2.42	12.80	2.50	12.20	2.67	12.20
	07	1.52	12.20	2.13	11.64	2.19	12.20	2.17	12.20
	13	1.36	12.20	2.16	11.64	2.17	11.64	2.02	11.14
	19	1.37	12.80	1.91	10.66	1.94	12.20	1.88	11.14
8	01	1.33	11.64	1.75	11.64	1.82	10.66	1.88	10.24
	07								
	13	1.15	12.20	1.29	System Crash 9.14	1.36	9.14	1.21	10.24
	19								
9	01				System Crash				
	07								
	13	0.75	4.49	0.87	9.84	0.89	10.24	0.92	8.83
	19	0.49	4.57	0.79	10.24	0.83	10.24	0.83	10.24
0	01	0.65	2.84	0.81	9.48	0.82	9.14	0.88	10.66
	07	0.37	12.20	0.70	10.66	0.69	9.48	0.76	10.66
	13	0.39	10.66	0.60	11.14	0.56	10.66	0.70	10.66
	19	0.39	9.94	0.62	10.24	0.64	10.66	0.73	9.14
1	01	0.44	9.48	0.59	9.84	0.56	10.66	0.82	9.84
	07	0.52	3.51	0.66	9.84	0.72	9.48	0.82	9.84
	13	1.24	5.95	1.06	5.95	1.07	5.95	1.56	5.82
	19	1.25	6.24	1.20	6.57	1.20	6.57	1.66	6.24
Mean	0.80	7.81	1.05	8.24	1.08	8.28	1.27	8.06	
Std dev	0.41	2.96	0.63	2.31	0.61	2.34	0.69	2.43	

* Electronic problems

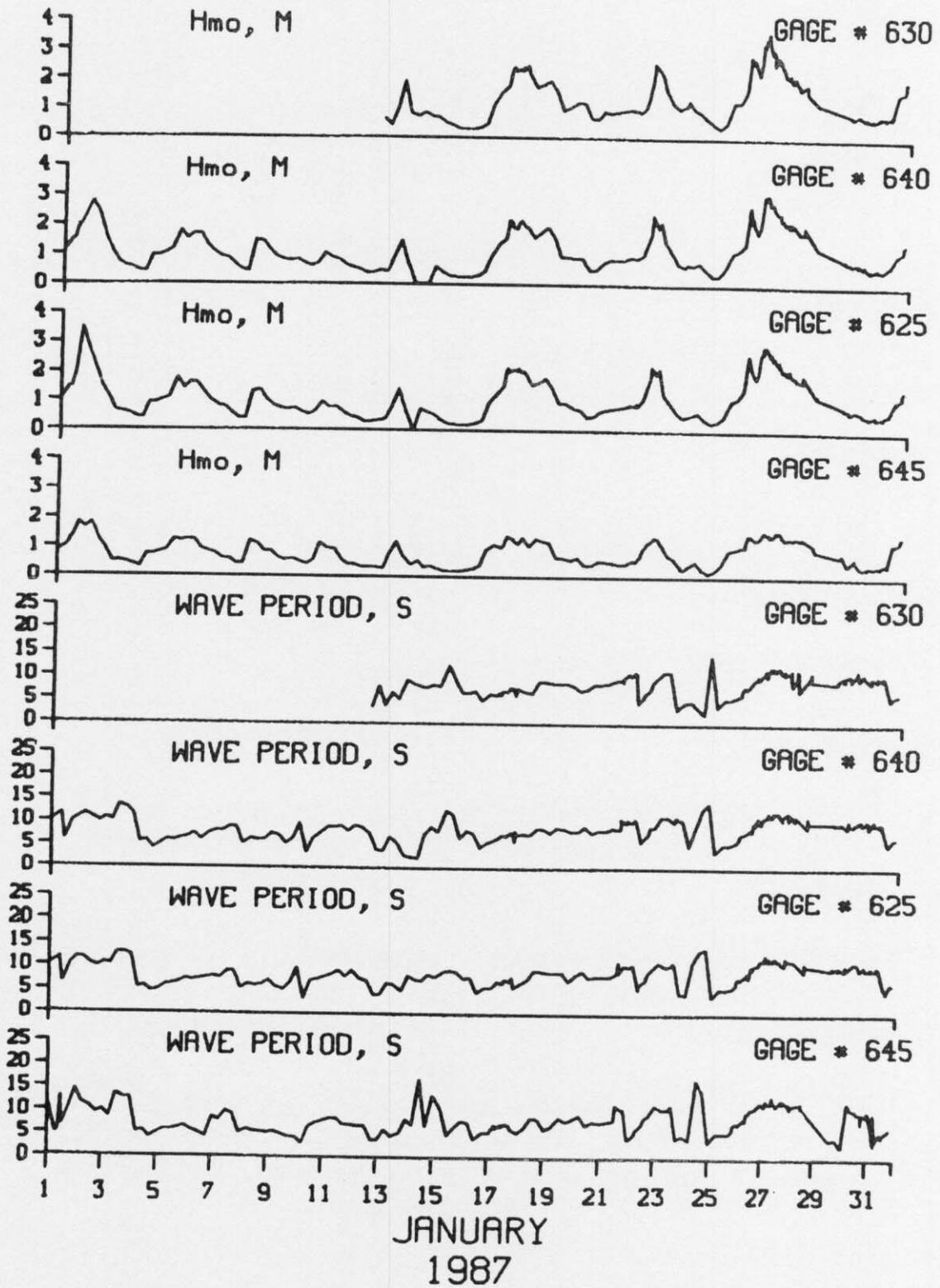


FIGURE 3. Time History of Wave Heights and Periods

IV. CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: Current Data
JAN 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
1	0100	-Along Cross Result									22 3 22	S on 168
1	0700	-Along Cross Result	22 5 22	S on 174	152	55 6 56	S off 154	North	23	S	20 3 20	S on 169
1	1300	-Along Cross Result									22 12 25	S on 189
1	1900	-Along Cross Result									71 18 73	N on 326
2	0100	-Along Cross Result									1 11 11	S on 245
2	0700	-Along Cross Result	51 10 52	S off 149	262	20 41 45	S off 97	North	70	N	32 17 36	S on 188
2	1300	-Along Cross Result									1 0 1	S 160
2	1900	-Along Cross Result									12 5 13	N off 3
3	0100	-Along Cross Result									2 4 4	S on 223
3	0700	-Along Cross Result	0 10 10	off 70	140	6 13 14	S off 97	North	6	S	20 8 22	N off 2
3	1300	-Along Cross Result									21 0 21	N 340
3	1900	-Along Cross Result									24 5 25	N off 352
4	0100	-Along Cross Result									13 4 14	N off 357
4	0700	-Along Cross Result	5 2 6	S off 143	177	47 0 47	S 160	North	53	S	3 0 3	N 340
4	1300	-Along Cross Result									10 9 13	S on 202
4	1900	-Along Cross Result									19 2 19	S on 166
5	0100	-Along Cross Result									25 5 25	S on 171
5	0700	-Along Cross Result	76 0 76	S 160	274	87 0 87	S 160	North	75	S	42 6 42	S on 168
5	1300	-Along Cross Result									50 7 50	S on 168
5	1900	-Along Cross Result									48 8 49	S on 169

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
JAN 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
6	0100	-Along Cross Result									38 5 38	S on 167
6	0700	-Along Cross Result	55 0 55	S 160	226	61 24 66	S on 182	North	84	S	29 1 29	S on 162
6	1300	-Along Cross Result									21 0 21	S 160
6	1900	-Along Cross Result									24 4 24	S on 169
7	0100	-Along Cross Result									4 7 8	S off 100
7	0700	-Along Cross Result	23 17 28	N off 17	165	20 5 21	N off 354	North	18	N	9 4 10	N off 4
7	1300	-Along Cross Result									11 5 12	N off 4
7	1900	-Along Cross Result									13 2 13	N off 349
8	0100	-Along Cross Result									23 5 24	S on 172
8	0700	-Along Cross Result	19 0 19	S 160	189	55 6 56	S off 154	South	53	S	15 8 17	S on 188
8	1300	-Along Cross Result									6 4 7	S on 194
8	1900	-Along Cross Result									2 2 3	N on 295
9	0100	-Along Cross Result									7 4 8	N on 310
9	0700	-Along Cross Result	8 2 8	N on 329	165	19 8 21	S off 138	North	14	S	2 0 2	N 340
9	1300	-Along Cross Result									7 1 7	S on 168
9	1900	-Along Cross Result									20 7 21	S on 179
10	0100	-Along Cross Result									11 9 14	S on 199
10	0700	-Along Cross Result	9 2 9	N off 351	151	41 6 41	N off 349	South	54	N	10 7 12	S on 195
10	1300	-Along Cross Result									0 2 2	off 70
10	1900	-Along Cross Result									8 1 8	S on 167

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
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on = onshore off = offshore

TABLE 4: Current Data
JAN 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
11	0100	-Along Cross Result								4 8 9	S on 223	
11	0700	-Along Cross Result	47 14 49	S off 143	152	29 23 37	N off 19	South	4	N	7 1 7	S on 168
11	1300	-Along Cross Result									1 1 1	N off 25
11	1900	-Along Cross Result									17 1 17	S off 157
12	0100	-Along Cross Result									1 0 1	S 160
12	0700	-Along Cross Result	6 24 25	S off 85	152	10 17 20	S off 99	North	13	S	8 8 11	N off 25
12	1300	-Along Cross Result									8 5 9	N off 12
12	1900	-Along Cross Result									1 4 4	S on 236
13	0100	-Along Cross Result									8 4 9	S on 187
13	0700	-Along Cross Result	0 5 5	off 70	262	51 8 51	S off 151	North	41	S	5 7 9	S on 214
13	1300	-Along Cross Result									7 1 7	N on 332
13	1900	-Along Cross Result									7 1 7	N off 348
14	0100	-Along Cross Result									8 4 9	N off 7
14	0700	-Along Cross Result	17 4 17	N off 354	152	22 11 24	S off 133	South	4	S	8 4 9	N off 7
14	1300	-Along Cross Result									1 3 3	N off 52
14	1900	-Along Cross Result									2 2 3	N on 295
15	0100	-Along Cross Result									6 2 6	S on 178
15	0700	-Along Cross Result	11 4 12	N off 2	140	6 3 7	N off 7	South	3	N	7 1 7	N off 348
15	1300	-Along Cross Result									5 2 5	N off 2
15	1900	-Along Cross Result									0 2 2	off 70

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on = onshore off = offshore

TABLE 4: Current Data
JAN 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
16	0100	-Along Cross Result								8 2 8	S on 174	
16	0700	-Along Cross Result	25 1 25	S on 163	152	13 1 13	S on 166	North	17	S	5 6 8	S on 210
16	1300	-Along Cross Result								25 3 25	S on 167	
16	1900	-Along Cross Result								29 5 29	S on 170	
17	0100	-Along Cross Result								38 6 38	S on 169	
17	0700	-Along Cross Result	68 7 68	S off 154	311	51 13 52	S off 146	no observation			47 7 48	S on 168
17	1300	-Along Cross Result								51 7 51	S on 168	
17	1900	-Along Cross Result								54 4 54	S on 164	
18	0100	-Along Cross Result								31 5 31	S on 169	
18	0700	-Along Cross Result	9 4 10	S on 182	207	36 22 42	N off 11	South	55	N	12 7 14	S on 190
18	1300	-Along Cross Result								11 2 11	S on 170	
18	1900	-Along Cross Result								7 1 7	S off 152	
19	0100	-Along Cross Result								14 5 15	S on 180	
19	0700	-Along Cross Result	11 2 11	S off 151	140	51 20 55	N off 2	South	18	N	10 0 10	S on 160
19	1300	-Along Cross Result								23 6 24	S off 145	
19	1900	-Along Cross Result								12 9 15	S off 123	
20	0100	-Along Cross Result								25 0 25	S on 160	
20	0700	-Along Cross Result	23 2 23	S off 154	152	4 1 4	S off 151	North	2	S	12 10 16	S on 200
20	1300	-Along Cross Result								21 3 21	S on 168	
20	1900	-Along Cross Result								21 2 21	S on 165	

KEY = All speeds in CM/SEC
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on = onshore off = offshore

TABLE 4: Current Data
JAN 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
21	0100	-Along Cross Result								19 6 20	S on 178	
21	0700	-Along Cross Result	24 1 24	S off 157	201	19 19 27	S off 115	South	8	N	9 5 10	S on 189
21	1300	-Along Cross Result									13 6 14	S on 185
21	1900	-Along Cross Result									19 2 19	S on 166
22	0100	-Along Cross Result									18 5 19	S on 176
22	0700	-Along Cross Result	38 8 39	S on 171	no observation			no observation			31 7 32	S on 173
22	1300	-Along Cross Result									34 4 34	S on 167
22	1900	-Along Cross Result									19 1 19	S on 163
23	0100	-Along Cross Result									6 6 8	S off 115
23	0700	-Along Cross Result	16 12 21	N off 17	165	20 15 25	N off 17	South	15	N	12 5 13	N off 3
23	1300	-Along Cross Result									8 5 9	N off 12
23	1900	-Along Cross Result									17 3 17	S off 150
24	0100	-Along Cross Result									6 8 10	N off 33
24	0700	-Along Cross Result	36 7 37	N off 351	165	19 6 20	N off 357	South	12	N	296 3 296	S off 159
24	1300	-Along Cross Result									18 5 19	N off 356
24	1900	-Along Cross Result									10 1 10	N off 346
25	0100	-Along Cross Result									3 1 3	N off 358
25	0700	-Along Cross Result	23 2 23	S on 166	213	68 7 68	S on 166	North	49	S	24 4 24	S on 169
25	1300	-Along Cross Result									26 4 26	S on 169
25	1900	-Along Cross Result									33 6 34	S on 170

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
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on = onshore off = offshore

TABLE 4: Current Data
JAN 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
26	0100	-Along Cross Result								44 10 45	S on 173	
26	0700	-Along Cross Result	122 12 123	S off 154	262	76 19 79	S off 146	North	40	S	61 8 62	S on 167
26	1300	-Along Cross Result									81 17 83	S on 172
26	1900	-Along Cross Result									80 10 81	S on 167
27	0100	-Along Cross Result									65 9 66	S on 168
27	0700	-Along Cross Result	68 10 68	S on 169	262	36 11 37	S off 143	North	41	S	44 11 45	S on 174
27	1300	-Along Cross Result									45 7 46	S on 169
27	1900	-Along Cross Result									39 2 39	S on 163
28	0100	-Along Cross Result									23 4 23	S on 170
28	0700	-Along Cross Result	36 11 37	S on 177	165	47 2 47	S on 163	North	18	S		
28	1300	-Along Cross Result									5 4 6	S on 199
28	1900	-Along Cross Result										
29	0100	-Along Cross Result										
29	0700	-Along Cross Result	10 3 11	S on 174	152	18 1 18	S off 157	North	12	S		
29	1300	-Along Cross Result									5 1 5	S on 171
29	1900	-Along Cross Result									2 3 4	N off 36
30	0100	-Along Cross Result									7 2 7	S off 144
30	0700	-Along Cross Result	10 7 12	N off 17	165	18 5 19	N off 357	South	15	N	5 3 6	N off 11
30	1300	-Along Cross Result									0 3 3	on 250
30	1900	-Along Cross Result									3 4 5	N on 287

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TABLE 4: Current Data
JAN 1987

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
31	0100	Along Cross Result									2 6 6	N on 268
31	0700	Along Cross Result	51 13 52	S off 146	140	32 5 32	S off 151	North	42	S	12 8 14	S on 194
31	1300	Along Cross Result									27 5 27	S on 170
31	1900	Along Cross Result									21 5 22	S on 173

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 east of true north; consequently, wave angles greater than 70 imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

TABLE 5

SUPPLEMENTAL OBSERVATIONS

JAN 1987

DAY	TIME	WAVE APPROACH ANGLE:		RADAR WAVE: ANGLE deg	WIDTH OF SURF ZONE(m)	WATER CHARACTERISTICS AT PIER END		
		deg from True N Primary	deg from True N Secondary			TEMP(C)	DENSITY (g/cc)	SECCI VIS(m)
1	820	65		70	107	7.7	1.0229	0.6
2	800	80	60	70	360	7.4	1.0216	0.6
3	740	345		10	15	7.5	1.0238	0.6
4	750	20			131	7.8	1.0242	0.3
5	750	40		40	250	6.6	1.0235	0.3
6	730	30			165	5.7	1.0202	0.3
7	700	100			125	7.1	1.0230	0.6
8	700	50	345	50	262	6.7	1.0234	0.3
9	855	50			88	6.8	1.0232	0.6
10	720	none visible			14	6.7	1.0218	1.8
11	845	110		100	9	7.1	1.0217	2.1
12	930	60	115		12	6.8	1.0222	1.2
13	730	30		40	241	6.6	1.0238	1.8
14	730	30			76	6.8	1.0234	1.2
15	710	130			12	7.7	1.0244	0.9
16	710	10		10	6	8.1	1.0246	1.2
17	715	50	350	40	244	7.1	1.0229	0.6
18	740	100		20	244	6.9	1.0204	0.3
19	900	90	110		52	7.0	1.0218	0.6
20	710	30			18	6.8	1.0239	1.8
21	710	50			165	6.5	1.0224	1.5
22	700	50		40	317	6.7	1.0215	0.6
23	730	110	80		131	6.7	1.0234	0.3
24	710	140			110	5.6	1.0246	0.6
25	730	50		50	119	6.1	1.0244	0.6
26	710	50		50	372	5.1	1.0218	0.3
27	715	40		40	326	3.4	1.0222	0.3
28	710	50	350	70	171	2.5	1.0205	0.3
29	710	40		40	122	3.6	1.0220	0.9
30	710	100	60		49	5.2	1.0236	1.2
31	910	30	50	60	18	4.5	1.0238	0.9

VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865- 1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

FRF TIDE HEIGHTS
JAN 1987

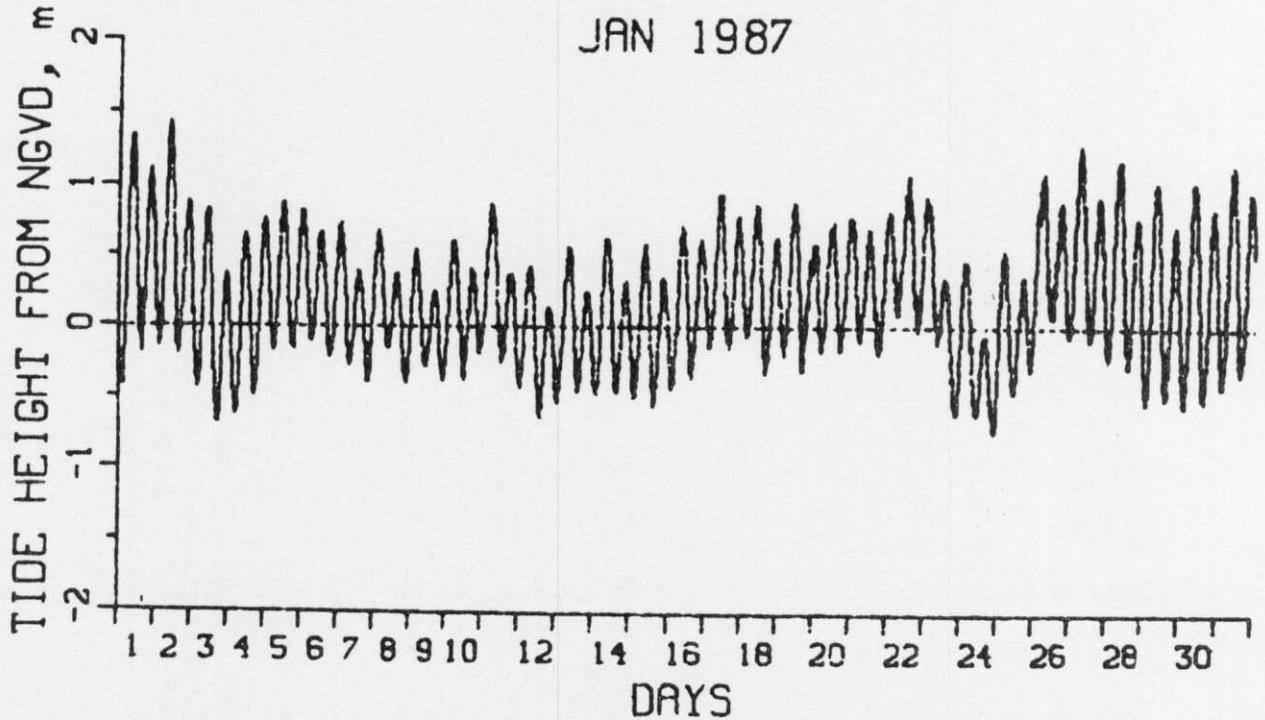


FIGURE 4. Time History of Mean Water Levels, January 1987

MONTHLY MEAN WATER LEVELS (METERS MSL)

Extreme Low -	-0.73	on 24 January at 2106 hrs.
Extreme High -	1.44	on 2 January at 0912 hrs.
Monthly Mean -	0.20	
Mean Low Water -	-0.34	
Mean High Water -	0.71	
Mean Range -	1.04	

MID-CYCLE DAY	TIME	LOW	HIGH	MEAN	RANGE
1	612	-0.43	1.34	0.50	1.77
1	1837	-0.20	1.10	0.47	1.30
2	703	-0.15	1.44	0.65	1.58
2	1928	-0.21	0.88	0.32	1.09
3	753	-0.44	0.82	0.17	1.26
3	2018	-0.68	0.37	-0.15	1.06
4	843	-0.62	0.65	0.02	1.27
4	2109	-0.49	0.77	0.17	1.26
5	934	-0.18	0.87	0.33	1.05
5	2159	-0.16	0.82	0.33	0.98
6	1024	-0.11	0.66	0.26	0.77
6	2249	-0.23	0.73	0.25	0.95
7	1115	-0.28	0.39	0.05	0.66
7	2340	-0.39	0.67	0.17	1.06
8	1205	-0.16	0.37	0.09	0.54
9	30	-0.40	0.54	0.08	0.94
9	1255	-0.28	0.25	-0.02	0.53
10	121	-0.38	0.60	0.13	0.98
10	1346	-0.38	0.41	0.05	0.79
11	211	-0.19	0.86	0.34	1.05
11	1436	-0.26	0.37	0.08	0.63
12	301	-0.42	0.43	0.01	0.85
12	1527	-0.63	0.13	-0.21	0.76
13	352	-0.54	0.56	0.04	1.10
13	1617	-0.46	0.24	-0.10	0.70
14	442	-0.48	0.62	0.10	1.10
14	1707	-0.46	0.33	-0.07	0.79
15	532	-0.49	0.58	0.05	1.08
15	1758	-0.55	0.34	-0.09	0.90
16	623	-0.43	0.71	0.16	1.15
16	1848	-0.36	0.62	0.15	0.98
17	713	-0.15	0.93	0.40	1.08
17	1938	-0.14	0.78	0.30	0.92
18	804	-0.20	0.87	0.36	1.07
18	2029	-0.33	0.63	0.17	0.96
19	854	-0.21	0.87	0.33	1.08
19	2119	-0.31	0.59	0.23	0.91
20	944	-0.18	0.73	0.29	0.91
20	2210	-0.16	0.77	0.33	0.94
21	1035	-0.13	0.69	0.26	0.83
21	2300	-0.19	0.82	0.35	1.01
22	1125	0.09	1.08	0.55	0.99
22	2350	-0.04	0.92	0.45	0.95
23	1216	-0.55	0.34	0.04	0.89
24	41	-0.62	0.46	-0.05	1.08
24	1306	-0.63	-0.07	-0.36	0.56
25	131	-0.73	0.53	-0.03	1.27
25	1356	-0.45	0.35	-0.05	0.81
26	222	-0.30	1.08	0.49	1.38
26	1447	0.06	0.89	0.43	0.82
27	312	-0.07	1.27	0.61	1.34
27	1537	-0.09	0.92	0.38	1.01
28	402	-0.24	1.17	0.48	1.41
28	1628	-0.28	0.77	0.23	1.05
29	453	-0.53	1.03	0.28	1.56
29	1718	-0.51	0.71	0.10	1.22
30	543	-0.55	1.02	0.27	1.57
30	1808	-0.52	0.85	0.17	1.36
31	634	-0.42	1.14	0.37	1.55

TABLE 6
WATER LEVELS (METERS MSL)
Tidal Characteristics

VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in December 1986 and the three surveys taken during January on profile line 188, located 517 m south of the pier. Minor changes to the profile include some erosion on the foreshore (80 to 120 m) and a deepening of the nearshore trough (120 to 160 m) with a corresponding steepening of the nearshore bar. Offshore, a small seaward shift of the storm bar is visible (240 to 400 m).

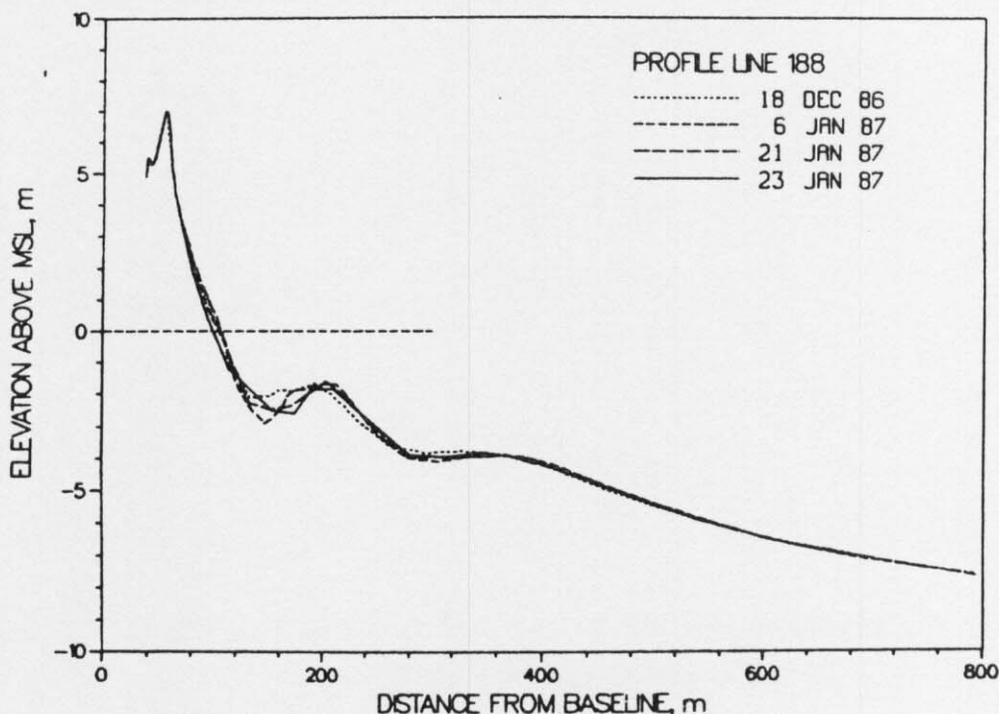


Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during January.

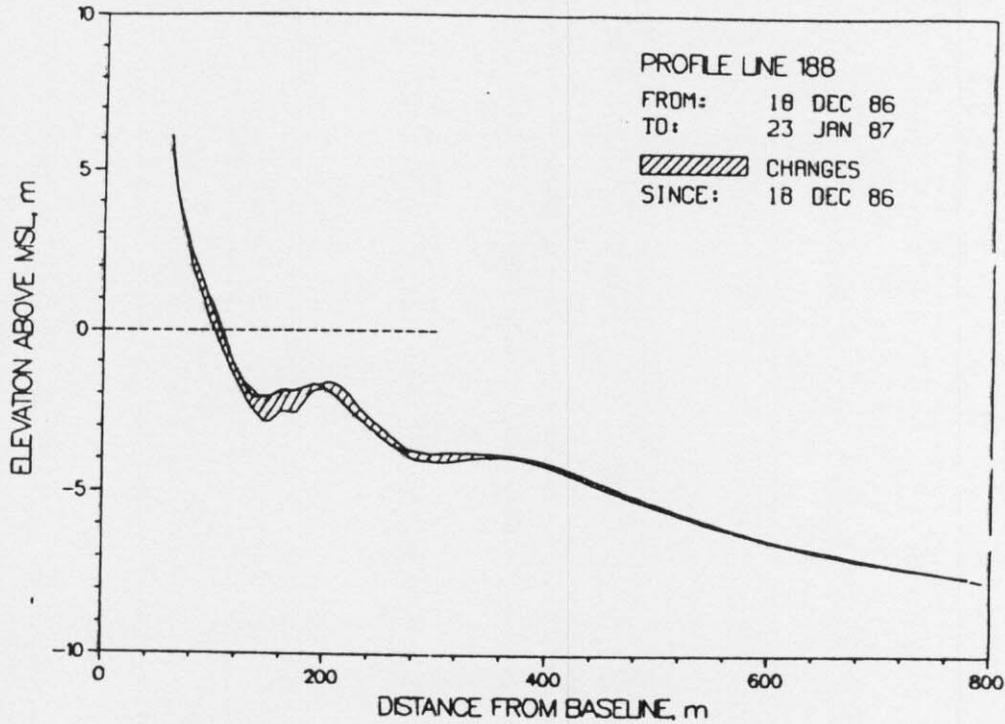


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. No bathymetric survey was conducted in January. The December bathymetric survey is given for reference.

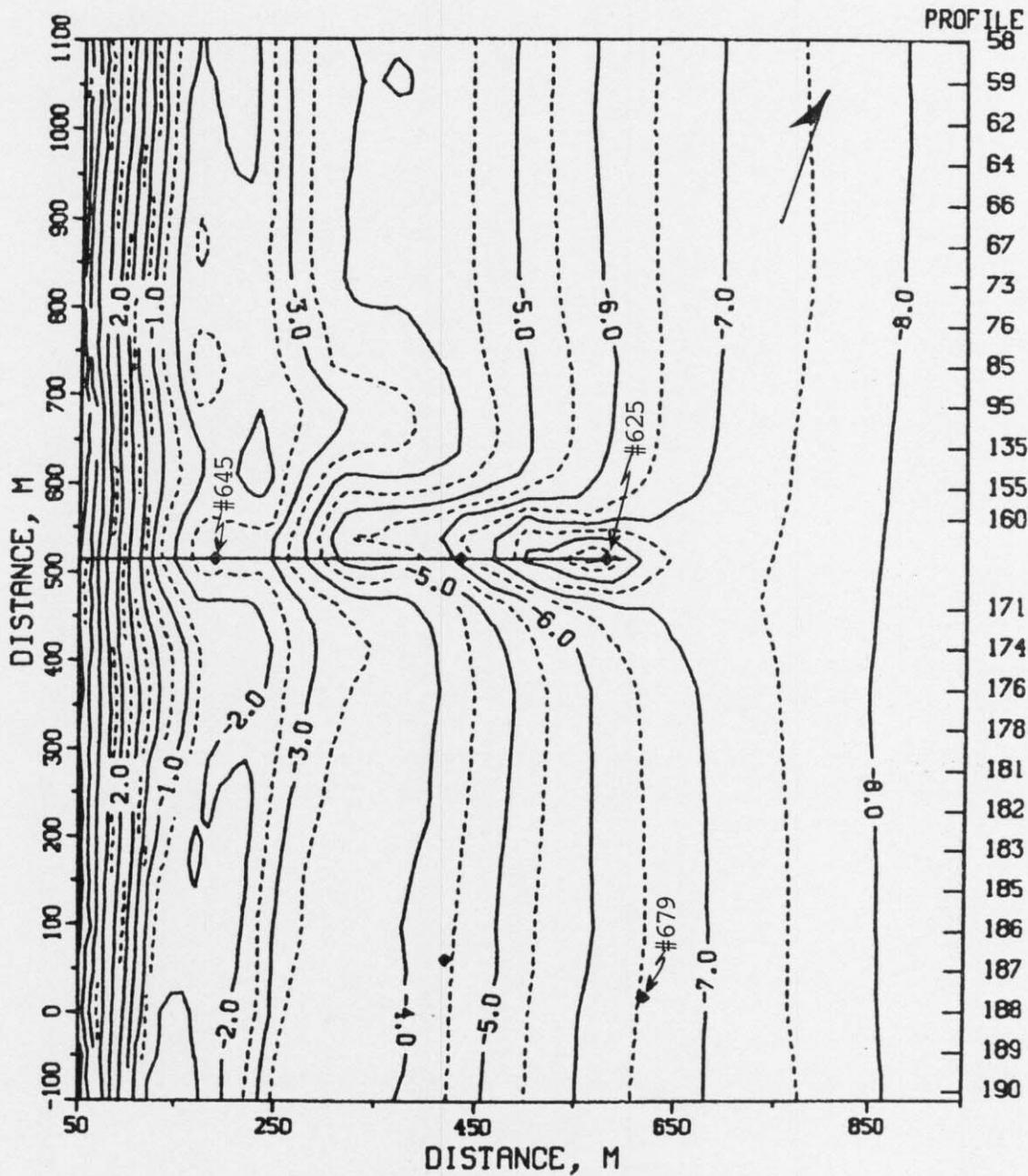


Figure 7. FRF BATHYMETRY 5 DEC 86
 CONTOURS IN METERS

VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height at the seaward end of the pier (i.e. as measured by the Baylor Gage #625 at pier station 19+00) exceeded 2 m. When this occurred, four contiguous 34-min wave records were obtained every hour:

<u>Start</u>	<u>End</u>
1 Jan (1500)	2 Jan (0800)-collected on NOVA-4
17 Jan (0400)	17 Jan (2000)
25 Jan (2200)	27 Jan (1334)

B. Storm Synopsis.

1-2 January - This storm formed over the Gulf of Mexico and early on 1 January was located off the Georgia coast. The storm increased in intensity and speed and rapidly moved up the coast. By the morning of 2 January, it was located off New England. By 2000 hrs on 1 January, the barometric pressure at the FRF had dropped to 993 mb. Maximum onshore winds (ENE) exceeded 12 m/s, and the maximum H_{m0} (at Gage 625) of 3.47 m ($T_p = 10.24$ sec) was recorded at 1900 hrs also on 1 January.

17 January - Following the passage of a cold front, strong onshore winds generated by a large Canadian high pressure system began to affect the FRF on the afternoon of 16 January. Maximum wind speeds exceeded 14 m/s (NNE) and the largest H_{m0} (at Gage 625) of 2.15 m ($T_p = 7.32$ sec) was recorded at 1400 hrs on 17 January. Total precipitation was 4 mm.

25-27 January - This low pressure system formed on 23 January over the western United States, later tracked over the southern United States, and early on 26 January moved offshore at Cape Hatteras, NC. On 25 January, onshore winds peaked at 17 m/s (NE) at 2200 hrs. The maximum H_{m0} of 2.96 m ($T_p = 10.66$ sec) was recorded at Gage #625 at 1600 hrs. on 26 January. The H_{m0} remained above 2 m for 33 hrs. Total precipitation was 22 mm.

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